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ANTARCTIC TABULAR ICEBERG A-24 MOVEMENT AND DECAY VIA SATELLITE REMOTE SENSING

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1. INTRODUCTION

Antarctic tabular iceberg A-24's historic northward path and breakup has been documented via a satellite multi-sensor effort. A combination of visible, infrared and passive microwave data enabled both the research and operational communities to witness the unusual track between the Falkland and South Georgia Islands. The demise of this huge iceberg (70 km x 80 km) was captured on imagery after more than 5 years since calving in the Weddell Sea from the Filchner Ice Shelf in 1986. The resultant array of smaller bergs, bergy bits and growlers produced a significant hazard to navigation.

This study utilized passive microwave data from the Special Sensor Microwave/Imager (SSM/I) to fill in the cloud covered time frames when visible and infrared (vis/IR) data was severely limited. The advantages of each sensor were incorporated within this effort to effectively monitor the berg's progress and eventual decay as it reached relatively warm waters near 50N, 50W.

2. REMOTE SENSING DATA SOURCES

The vis/IR imagery from the Advanced Very High Resolution Radiometer (AVHRR) and the Operational Linescan System (OLS) have been routinely used by the Navy/NOAA Joint Ice Center (JIC) to map tabular icebergs for weekly map products. Data from these polar

orbiting sensors is desired due to the huge swaths (eg., 2700-3000 km) and high spatial resolution (eg., 0.6-4.0 km depending on sensor/mode). However, frequent cloud obscuration required the incorporation of an additional "all weather" sensor in order to effectively monitor even these large tabular icebergs.

The SSM/I permits the user to observe icebergs under the majority of cloud conditions, Hawkins (1991), via its multi-frequency microwave channels. The 1394 km swath, Hollinger (1989), is usually sufficient at high latitudes to allow continuous coverage. Thus, sea ice concentration data at 25 km resolution was first retrieved to monitor iceberg A-24's movement when it broke free of the pack ice in September 1991. Subsequent northward movement was unlike that of previous icebergs A-20A, B and A-27,29, which normally move northeast towards South Georgia Island and decay.

Iceberg A-24 moved near 50N, 50W and began to exhibit unusual signals in the SSM/I sea ice concentration charts that were checked daily. SSM/I data was acquired, processed and enhanced in near real time to investigate these anomalous readings. 85 GHz imagery verified that the iceberg began to indicate more than one berg existed in mid-March and thus intensified our search for coincident visible imagery.

Our interest and search for coincident high resolution visible and infrared imagery intensified at this time and was rewarded on 2 April 1992. An excellent 1 km AVHRR visible

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image (Fig. 1) distinctly illustrates the massive breakup of A-24 into four major pieces and dozens of bergy bits and growlers. The image also clearly outlines the paths of hundreds of bergy bits 200-500 km to the east, indicating earlier partial breakup (mid March) had created an extensive field of bergy bits that was a hazard to navigation.

3. SUMMARY

Tabular iceberg A-24's unusual track between the Falkland Islands and South Georgia was successfully monitored via SSM/I imagery and its breakup was viewed with both SSM/I and vis/IR data. This decay phase has rarely been witnessed with such time series monitoring due in part to earlier sensor limitations and cloud conditions. The corresponding IR data was also of particular interest due to the wealth of mesoscale eddy activity revealed near A-24. Large

current shear and sea surface temperature gradients likely contributed in some degree to the final breakup. Future efforts should key on real time access to SSM/I, AVHRR, OLS, Synthetic Aperture Radar (SAR) and even altimeter data to gain greater insights into iceberg movement and evolution and the interaction between the coupled air-ocean temperature and momentum environment.

4. REFERENCES

Hawkins, J., S. Laxon, H. Phillips, 1991: Antarctic Tabular Iceberg Multi-Sensor Studies, Proceedings of IGARSS'91, pp. 1605-1608.

Hollinger, J., J.L. Pierce, G.A. Poe, 1990: SSM/I Instrument Evaluation, IEEE Trans. Geosci. Remote Sensing, Vol. 28, pp. 800-819.

* Now located at NRL Detachment Monterey.

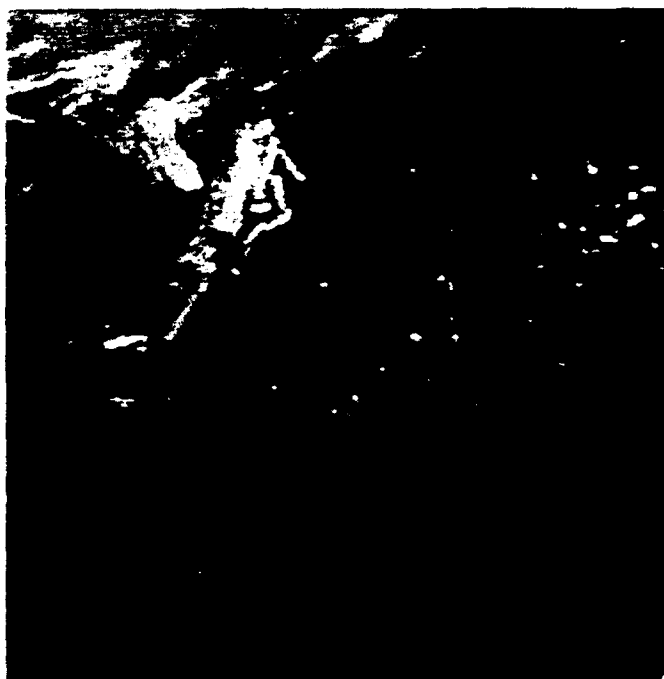


Figure 1. AVHRR visible image from April 2, 1992 depicting iceberg breakup.

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